Reflections

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Translations
Rotations
Dilations

Transforming Geometry into the Common Core with Transformations

with an Interactive Notebook foldable

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Reflections Transformations

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- Common Core Standards
- History and information about transformations
- Reflections
- Using this file
- Foldables - student and teacher copies

Understand congruence and similarity using physical models, transparencies, or geometry software.

> CCSS.Math.Content.8.G.A.1 Verify experimentally the properties of rotations, reflections, and translations:

« CCSS.Math.Content.8.G.A.1a Lines are taken to lines, and line segments to line segments of the same length.

« CCSS.Math.Content.8.G.A.1b Angles are taken to angles of the same measure.

« CCSS.Math.Content.8.G.A.1c Parallel lines are taken to parallel lines.

> CCSS.Math.Content.8.G.A.2 Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.

> CCSS.Math.Content.8.G.A.3 Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

> CCSS.Math.Content.8.G.A.4 Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

> CCSS.Math.Content.8.G.A.5 Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. *For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.*

Understand similarity in terms of similarity transformations

> CCSS.Math.Content.HSG-SRT.A.1 Verify experimentally the properties of dilations given by a center and a scale factor:

« CCSS.Math.Content.HSG-SRT.A.1a A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.

« CCSS.Math.Content.HSG-SRT.A.1b The dilation of a line segment is longer or shorter in the ratio given by the scale factor.

> CCSS.Math.Content.HSG-SRT.A.2 Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.

> CCSS.Math.Content.HSG-SRT.A.3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

Common Core Math Practices

The CCSSM expects mathematically proficient geometry students to

- experiment,
- explain,
- prove,
- visualize,
- understand,
- derive, and
- translate

between representations.

Students are expected to demonstrate geometric habits of mind, and be proficient in the Standards of Mathematical Practice.

Transformations

Leonhard Euler (1707-1783)

The first use of transformations dates back to the ancient Greeks around the time of Euclid. However, not until Euler (in 1776) did anyone identify all the kinds of transformations in space that could yield congruent figures.

It is interesting that the 3-dimensional analysis of congruence was accomplished before the 2-dimensional. This is probably because the congruent objects seen daily are 3-dimensional.

rotations reflections translations dilations

A transformation is a correspondence between sets of points such that each point in the image has exactly one preimage point.

Why study transformations?

- Studying these various transformations helps a person to become more aware of the movements of objects such as gears (which rotate) and conveyer belts (which slide).
- More complicated movements, such as those done by robots, can be taken apart into their component moves and analyzed.
- Transformations also appear in music and help to show some connections between mathematics and music.
- Things like cartoons, comics, flip books, storyboards, how-to books, and picture instructions use transformations to show motion

Reflection

Definition: A reflection is a transformation of the plane in which each point is mapped onto its reflection image over a line or plane often called a line of reflection. The line of reflection is the perpendicular bisector of the segment connecting a preimage with its reflection image.

Notation: $r_m(A) = A'$

Reflection of A over line m is A'

Properties: Reflection preserves

- collinearity,
- betweenness,
- distance, and
- angle measure

and has the same orientation.

> Note:
> Use a lower case r as the notation for reflections.
> The upper case R is used for rotations.

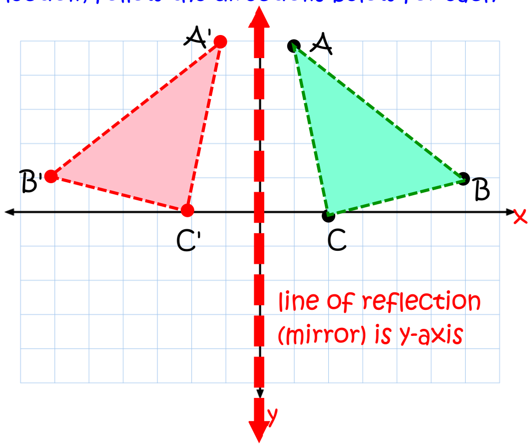
Reflection

To find an object's reflection, follow the directions below for each corner of the shape:

1. Measure from the point to the mirror line (must hit the mirror line at a right angle)

2. Measure the same distance again on the other side and place a dot.

3. Then connect the new dots, creating the triangle ABC's reflection!

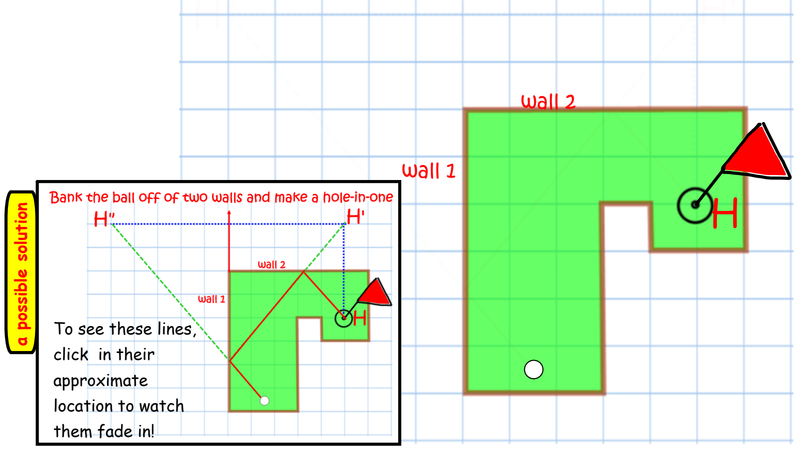


What are other ways of finding a reflection?

examples

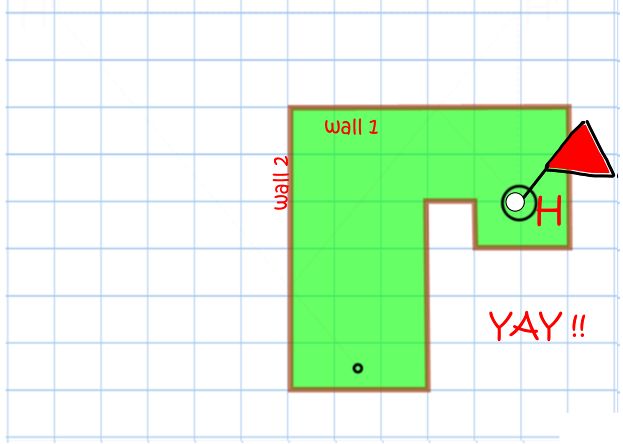
- paper folding
- patty paper
- mirrors
- miras/geo reflectors
- compass and straightedge
- dynamic software such as Geometer's Sketchpad, Cabri, Geogebra,
- technology-computers, graphing calculators with geometry software/graphing capabilities

Bank the ball off of two walls and make a hole-in-one

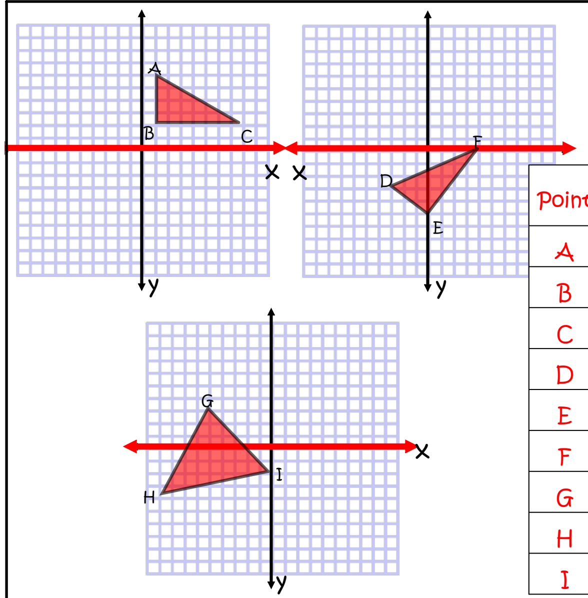


For more information on how to make holes-in-one in mini golf: http://geometrygems.wikispaces.com/Geometry+Projects

Bank the ball off of two walls and make a hole-in-one

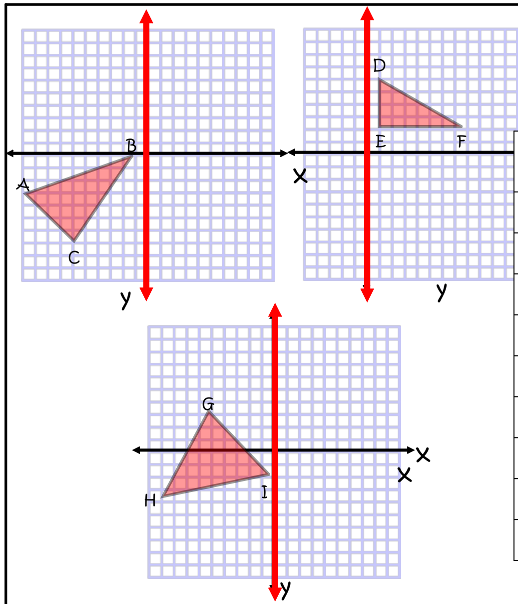


Play the video....



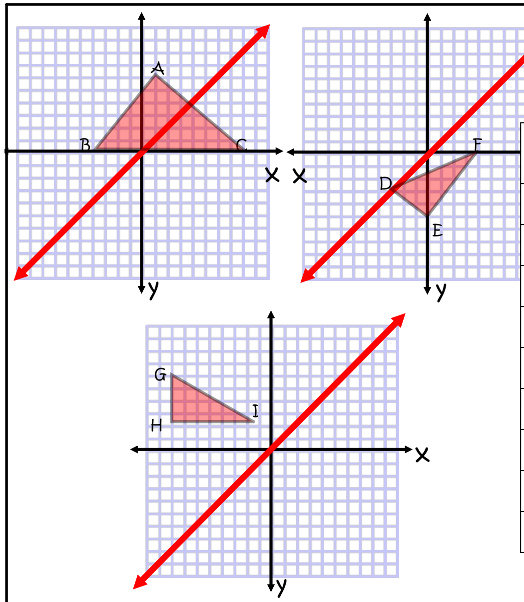
Reflect over the x-axis

Point	Pre-image	image
A	(1, 6)	(1,- 6)
B		
C		
D		
E		
F		
G		
H		
I		



Reflect over the y-axis

Point	Pre-image	image
A		
B		
C		
D	(1, 6)	(-1, 6)
E		
F		
G		
H		
I		



Reflect over the x = y

Point	Pre-image	image
A		
B		
C		
D		
E		
F		
G		
H		
I	(-1, 2)	(2, -1)

Summary

Use your notes from the last three pages and complete the chart below!

	Pre-image	Image	Orientation of the pre-image vs. image? (same or opposite)
Mirror x-axis	(x, y)		
Mirror y-axis	(x, y)		
Mirror y = x	(x, y)		

Foldables to put into an interactive notebook

Information

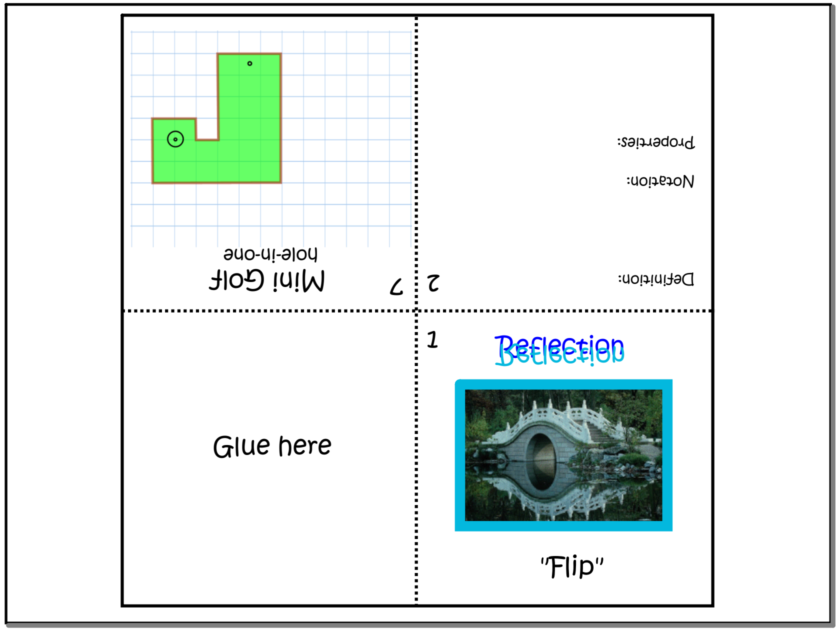
The foldable note sheets are meant to give students a place to summarize their findings and should in no instance substitute for explorations and investigations that will help students understand transformations/reflections. Take time to do the activities in this file and add other activities that will enrich students' understanding of transformations/reflections.

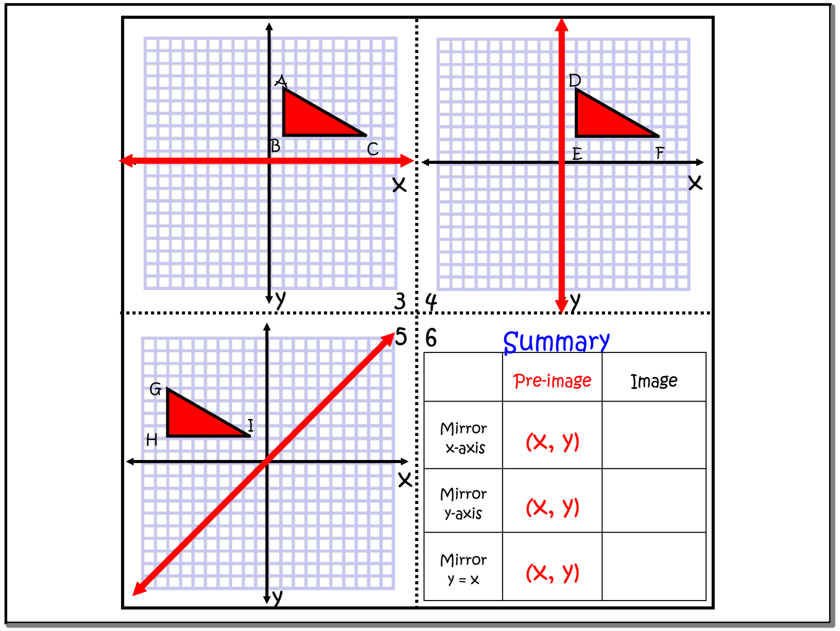
A set of foldable student notes and samples of teacher answers are included.

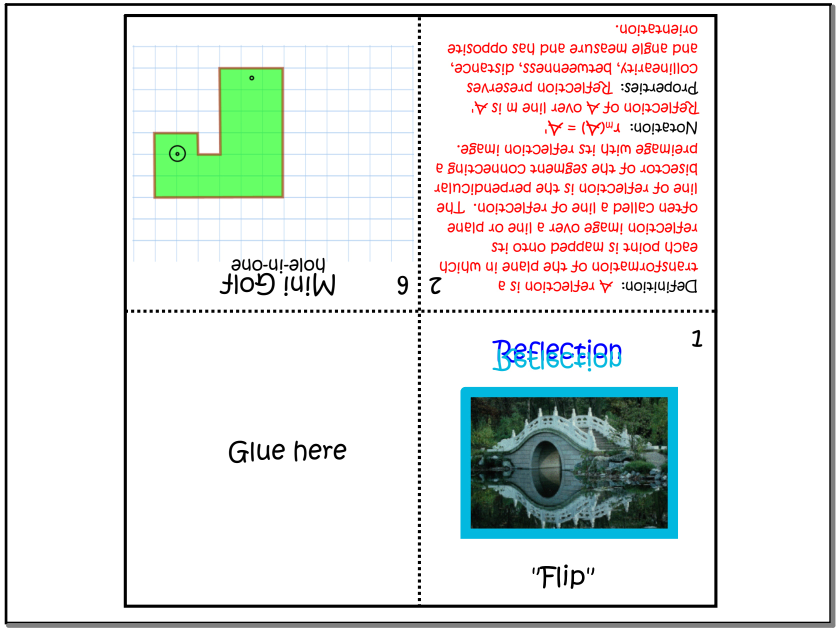
1. There are notes for reflections, translations, rotations, and dilations. Each set is two pages. If you are downloading the SMART Notebook file, you can easily edit them.

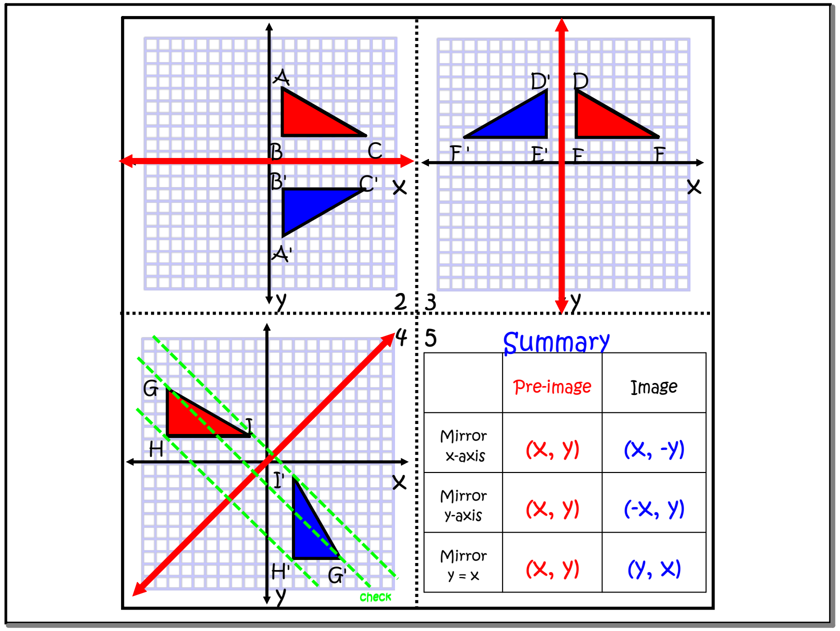
2. These notes are intended to be printed double sided and printed in color. If you print them, print them so that they are landscaped and flip on the short edge so the front lins up with the back. If you choose not to print them in color, students can easily add their own color to the notes.

3. The notes should be cut out and folded on the dotted lines. I will add pictures on http://GeometryGems.wikispaces.com/iMathination/ to show you what these notes look like when they are folded.


Mini Golf
hole-in-one
7
2
Definition:
Notation:
Properties:
1
Reflection
Glue here
"Flip"


A
B
C
x
y
3
D
E
F
x
y
4
G
H
I
x
y
5
6
Summary
Pre-image
Image
Mirror x-axis
(x, y)
Mirror y-axis
(x, y)
Mirror y = x
(x, y)


Mini Golf
hole-in-one
6
2
Definition: A reflection is a transformation of the plane in which each point is mapped onto its reflection image over a line or plane often called a line of reflection. The line of reflection is the perpendicular bisector of the segment connecting a preimage with its reflection image.
Notation: r_m(A) = A'
Reflection of A over line m is A'.
Properties: Reflection preserves collinearity, betweenness, distance, and angle measure and has opposite orientation.
1
Reflection
Glue here
"Flip"


A
B
C
B'
C'
A'
x
y
2
D'
D
F'
E'
E
F
x
y
3
G
H
I
I'
H'
G'
x
y
check
4
5
Summary
Pre-image
Image
Mirror x-axis
(x, y)
(x, -y)
Mirror y-axis
(x, y)
(-x, y)
Mirror y = x
(x, y)
(y, x)